UTokyo OCEAN ALLIANCE

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Towards Socially and Ecologically Adaptive Fisheries Resource Governance: A Case of Spiny Lobster Fishery in Shima Peninsula, Japan

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PICES Annual Meeting

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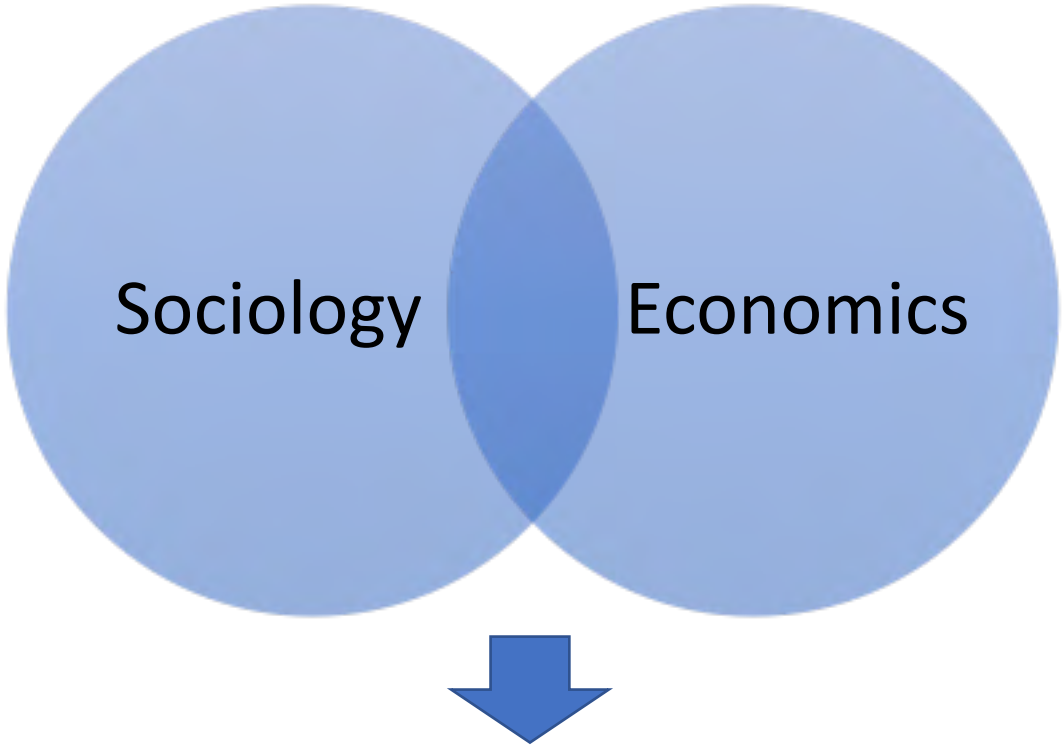
Objective (simply put)

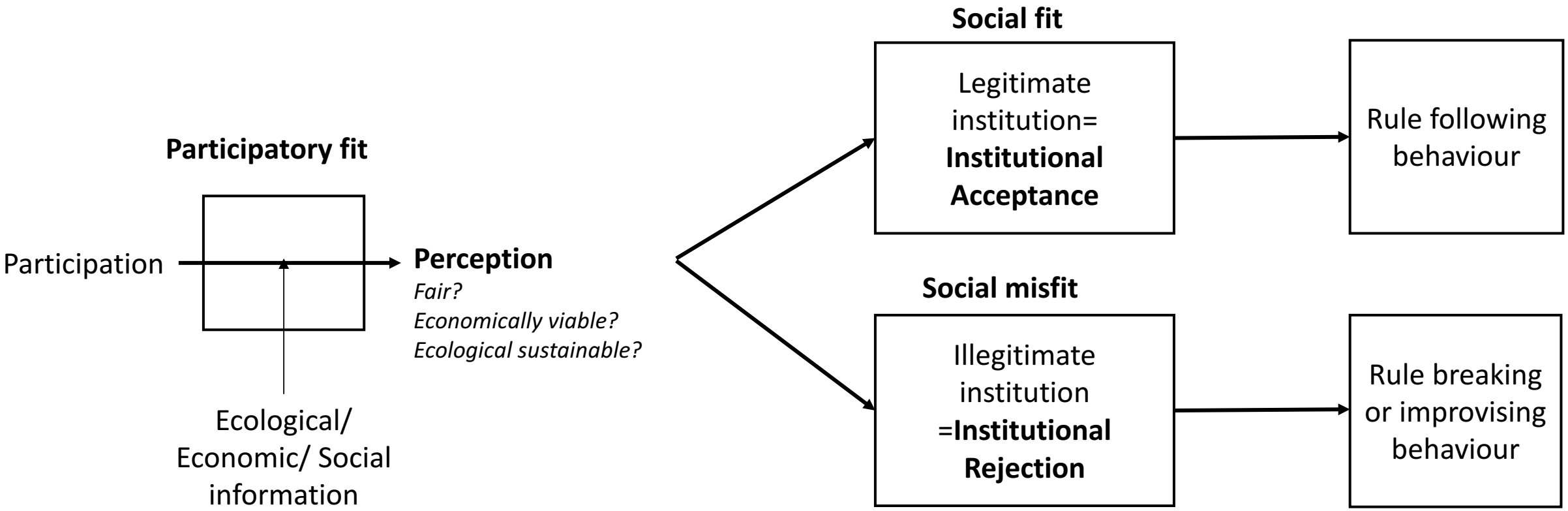


Adaptive fisheries resource management **institution**

Outline

- Conceptual framework
  - Institutional fit (Berkes and Folke 1998, Young 2002)
- Japanese coastal fisheries management institution
  - TURF & Cooperatives
- Case: Spiny lobster fishery in Shima Peninsula, Japan

Institutional fit?



Modified from DeCaro and Stokes (2013)

Institutional fit?

Ecological aspect: Fit between ecosystem and institution	**Social aspect:** Fit between the social system and institution
1. **Spatial fit**: fit between the scale of institution and ecosystem 2. **Temporal fit**: fit between the management cycle and ecosystem cycle	1. **Participatory fit:** fit between stakeholder and institution (Brown 2003) 2. **Social fit:** Fit between human expectation/ behavioural patterns and institutions (DeCaro and Stoke 2013)

Critique:

1. Precise functioning of a ecosystem not clear → hard to determine spatial/temporal fit
2. Actors' expectation, values, knowledge of the ecosystem influence institutional outcome

Broaden the concept of institutional fit

- Fit between actors' expectation/values/ knowledge and the institution designed to manage CPRs,
  - Need to consider more than the fit between the spatial/temporal scale of ecosystem and the institution

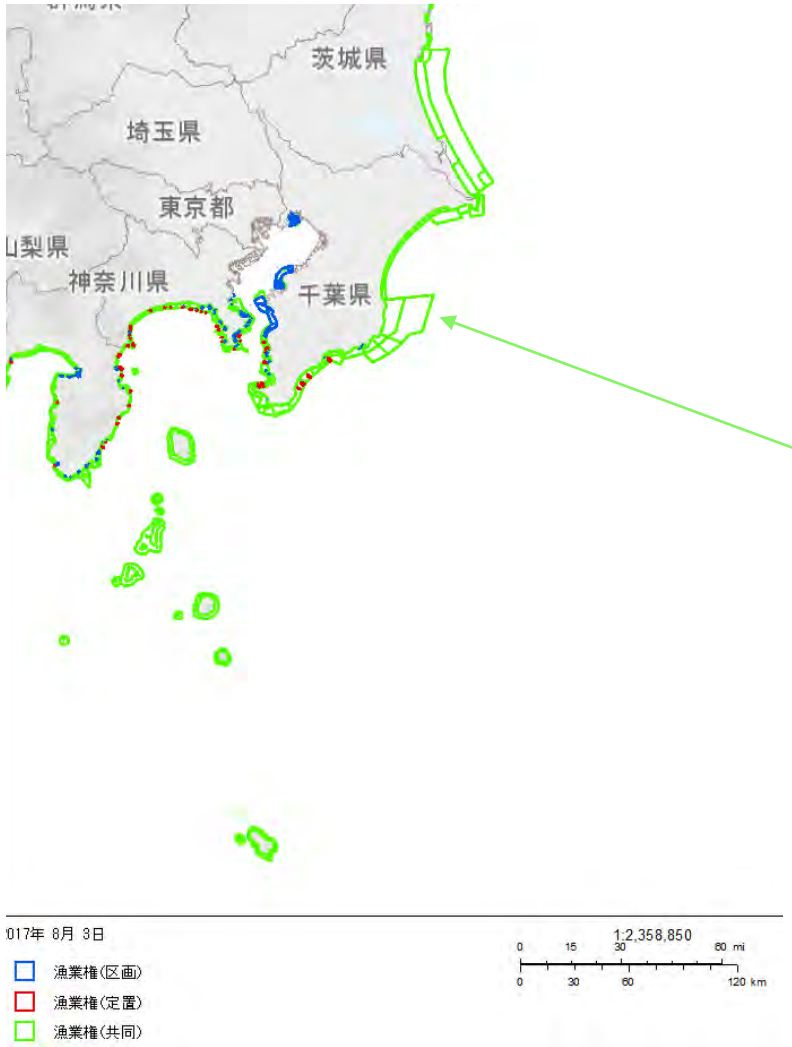
- Compatibility between
  - **Common knowledge**: A shared belief about how the game is played and to be played (Aoki 2007)
  - **Institutional context**: Social, cultural, political and economic context that the institutions are introduced

Common knowledge and ecological functioning

- Fishermen possess *certain* common knowledge about the ecological functioning and the boundaries of ecosystem to certain extent
  - Ex. knowledge of the fishing ground

How would it be revealed in the resource governance?

Underlying institution: Japanese Fisheries Governance



Offshore Areas:

- Prefectural or ministerial licenses
- Open access fisheries

Coastal Areas:

- Space-based rights, managed by local Fisheries Cooperatives Association
  - Territorial Use Rights Fisheries (TURFs) managed by local cooperatives

TURF & Cooperatives

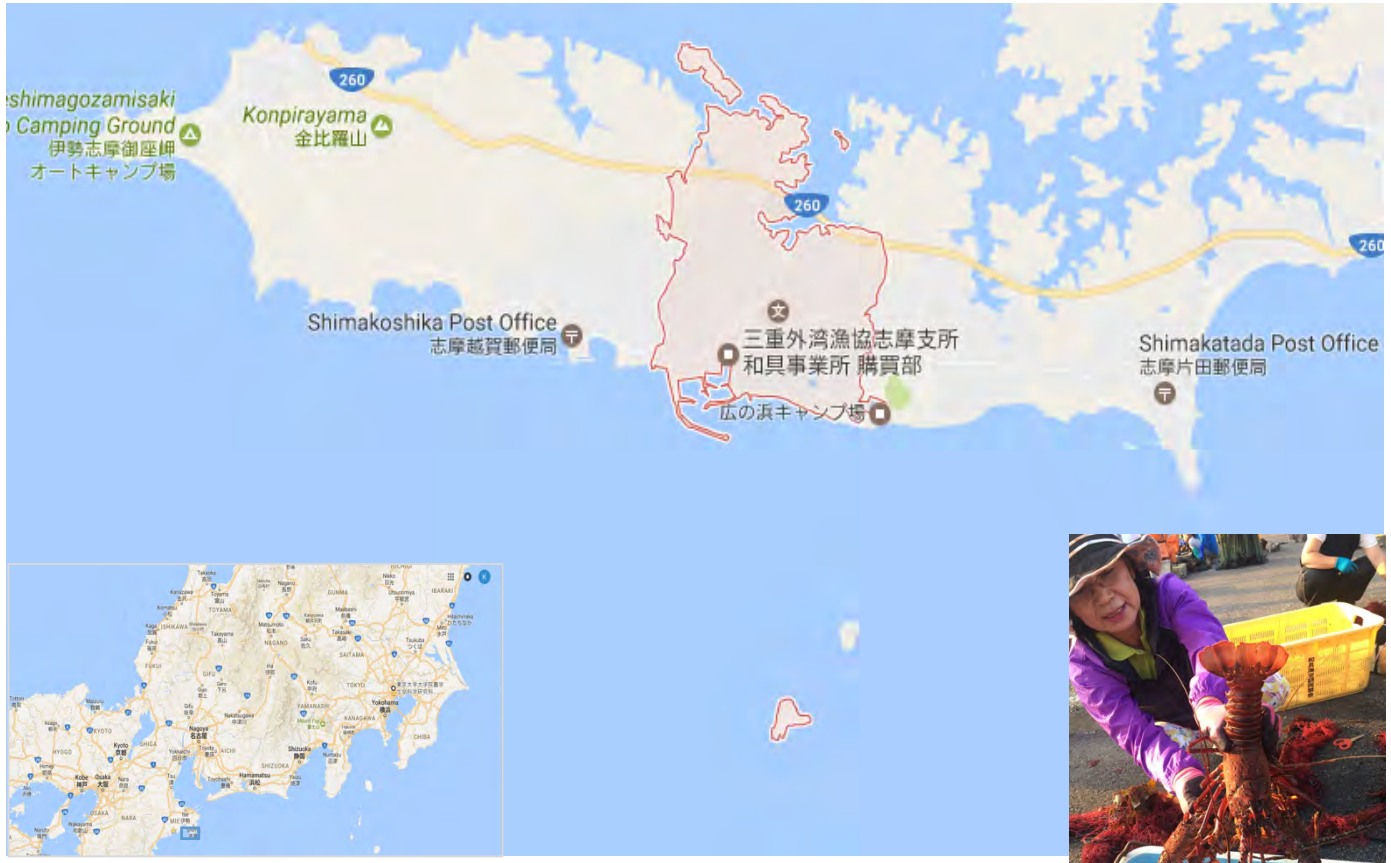
Deacon 2012, Cancino et al. 2007

- **Territorial Use Rights Fisheries (TURF)** claim ownership on a spatial basis
  - Well-defined spatial units
  - Exclusive access rights given to well-defined groups of fishermen
- **Cooperatives** contractually control the actions of members

Japanese coastal fisheries: TURF & Cooperatives

Case Study: Wagu Spiny Lobster Fishery

- Shima Peninsula in Mie prefecture
- Largest producer (#1 or #2) of spiny lobster in Japan
- Annual Production: 20 - 40 metric ton



Data

- Qualitative:
  - In-person interviews with the leaders
    - August 2016, November 2016, February 2017, April 2017
  - Interview surveys (15 out of 26 fishermen)
    - April 2017
- Quantitative:
  - Daily landing data (2013 – 2014)[1)]
  - Daily operation data (2013 – 2016, Pooling period only)[2)]
  - Daily auction data (1974 – 1996)[3)]
  - Daily operation data (1991- 1997)[3)]

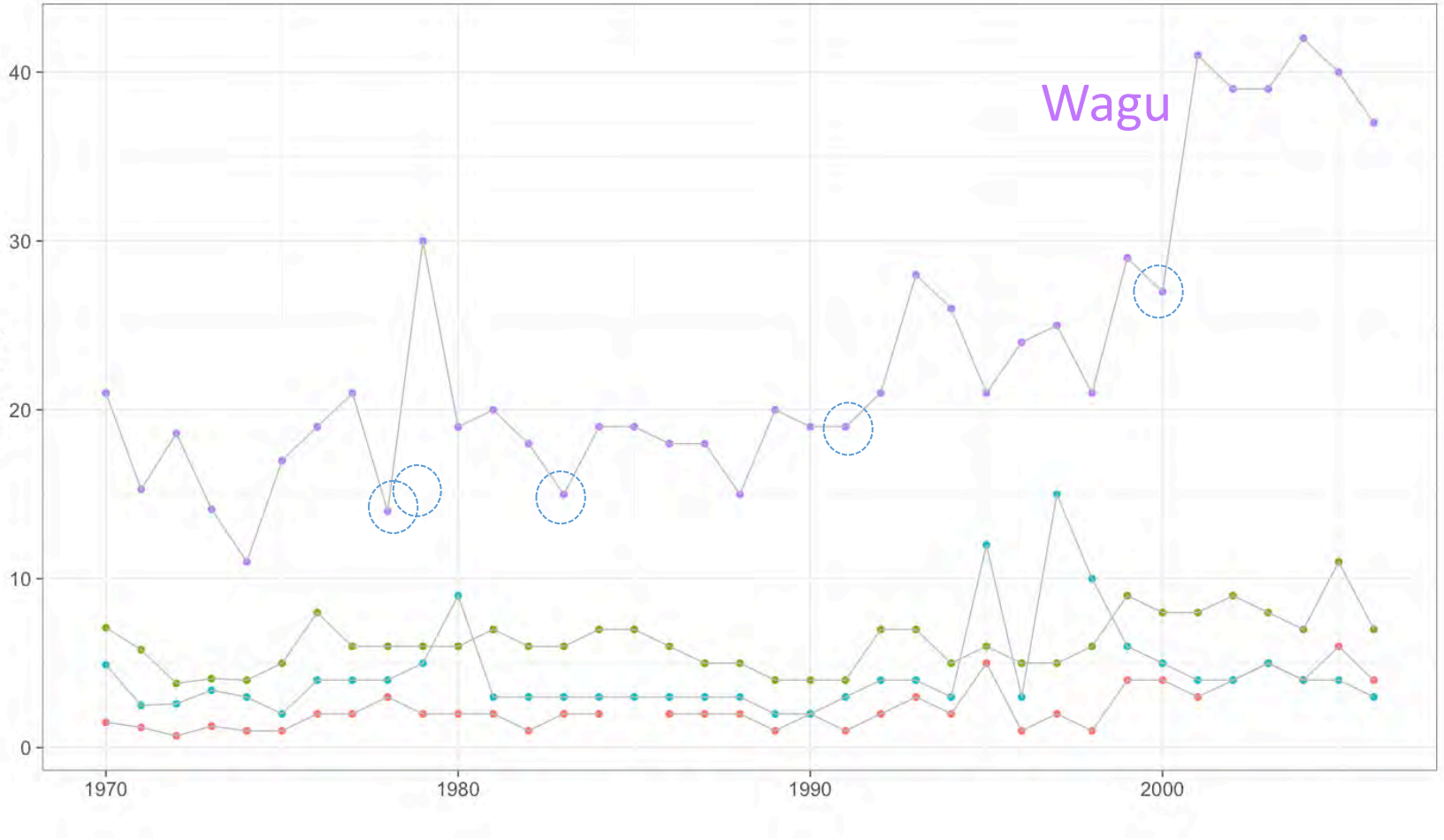
Data source: 1) Mie gaiwan FCA, 2) Wagu Lobster Assoc., 3) Takashi Yamakawa (U. Tokyo)

Wagu Spiny Lobster Fishery

- 26 owner operators (as of 2017)
- Season: October 1 – April 30
  - Closure from May 1– Sept 30 to protect spawning stocks (prefectural management measure)
- Voluntary Management Measures
  - Gear restriction
    - Thickness of the net
    - Number of nets
  - No harvesting during full moon (lunar calendar days 13-18)
  - Individuals <100g released to designated area

Brief History of the Wagu Spiny Lobster Fishery Management

Harvest (kg)



1932:	Wagu Trammel Net Spiny Lobster Assoc.
1978:	Gear restrictions Max # nets = 15
1987:	Max # nets = 13
1991:	Closing days Lunar calendar day 13 – 18
2000:	Max # nets = 10
2000s:	Gradual expansion of **Effort & revenue pooling**

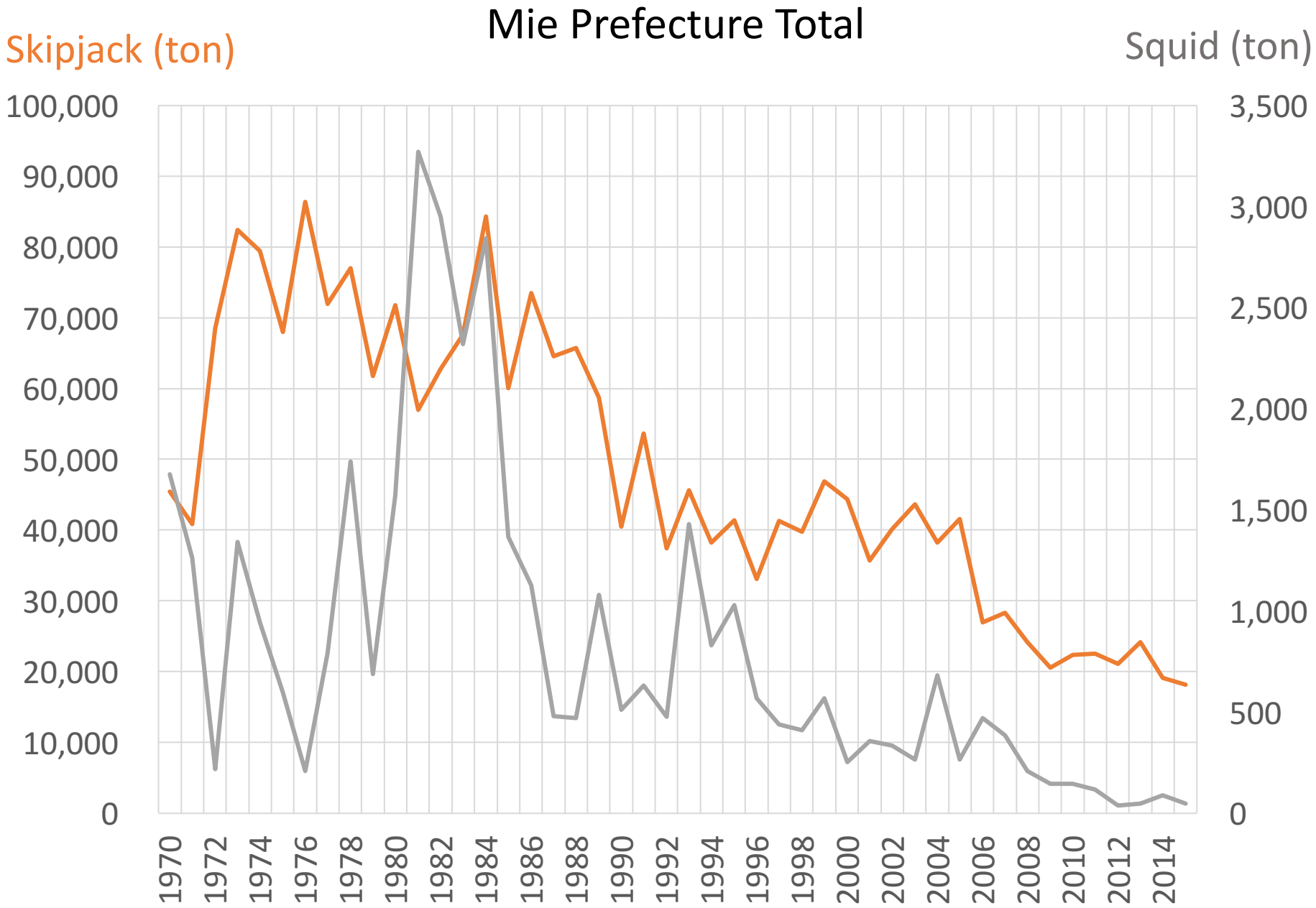
Data: Mie Prefecture Fisheries Research Institute

Misfit 1:
↓ catch of primary targets

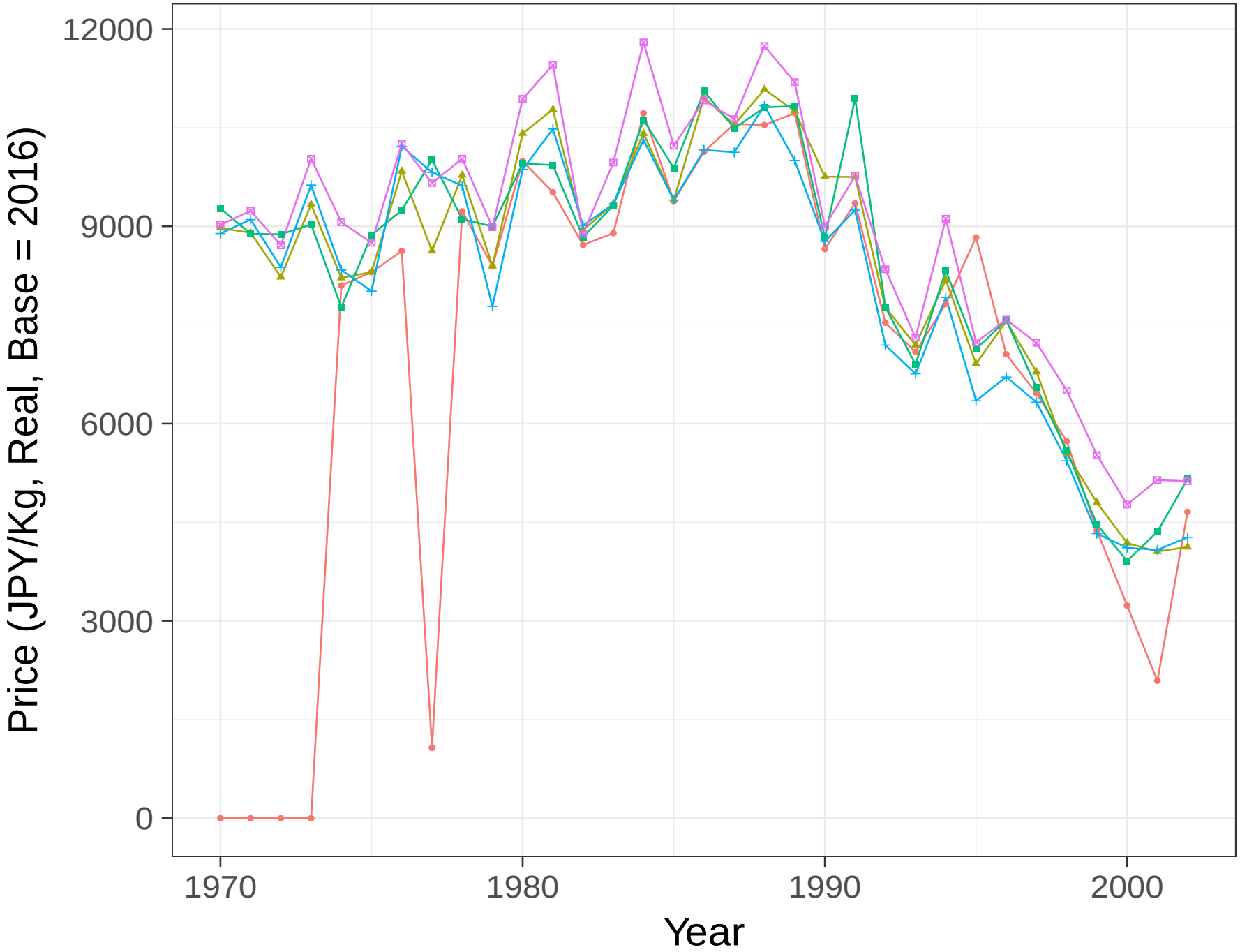
Spiny lobster was **the secondary** income source

↓

↑ reliance on spiny lobster



Data Source: Fisheries Agency of Japan


12000
9000
6000
3000
0
Price (JPY/Kg, Real, Base = 2016)
1970
1980
1990
2000
Year

↓ Price

Misfit 2:

Aging Population

- Relatives and local seniors help remove lobsters from the nets
- The helpers are compensated by fish caught in the nets
- They may also receive rice and other gifts at the end of the season as a token of thanks

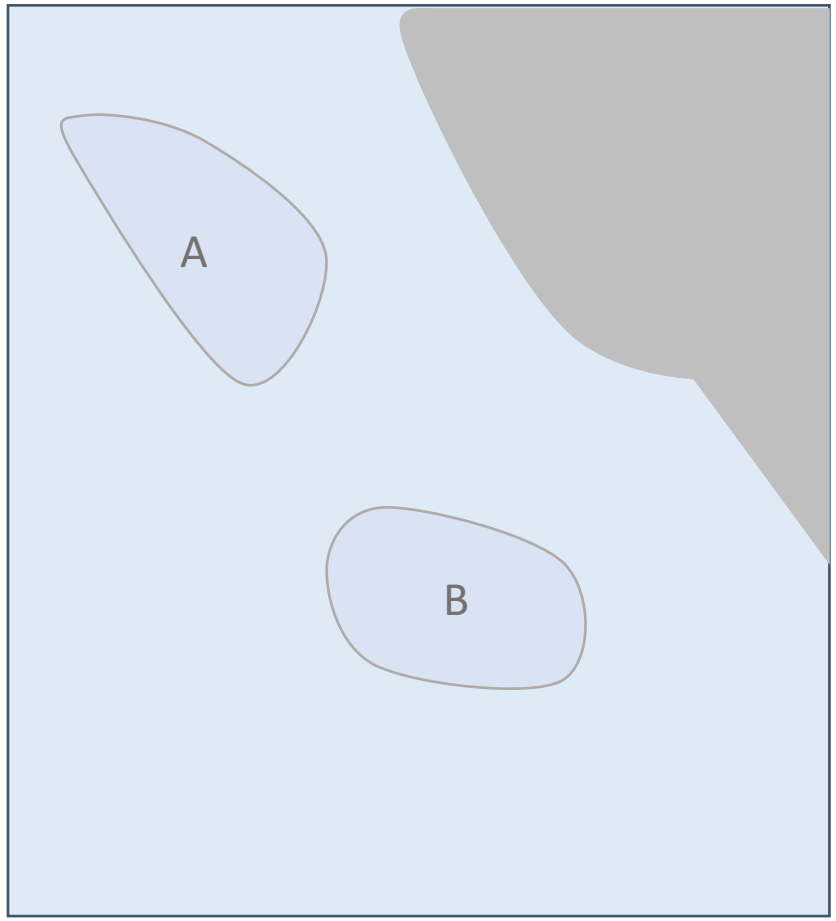
Group operation &revenue sharing in protected areas

Traditionally,

Protected areas

→ Benefits shared by all members

- Festivals
- Events
- New years' bonus



Adaptation: Expand protected areas & group operation

Current management institution: Hybrid group and individual operation

Group Operation (Protected Area)

- Beginning of the season
- 26 owner-operators x 2 nets
- Group operation: 5 groups
- Effort pooling & revenue sharing (≃ profit sharing)
- Lobster assoc. president, vice president, and group leaders decide where to set nets

Individual Operation

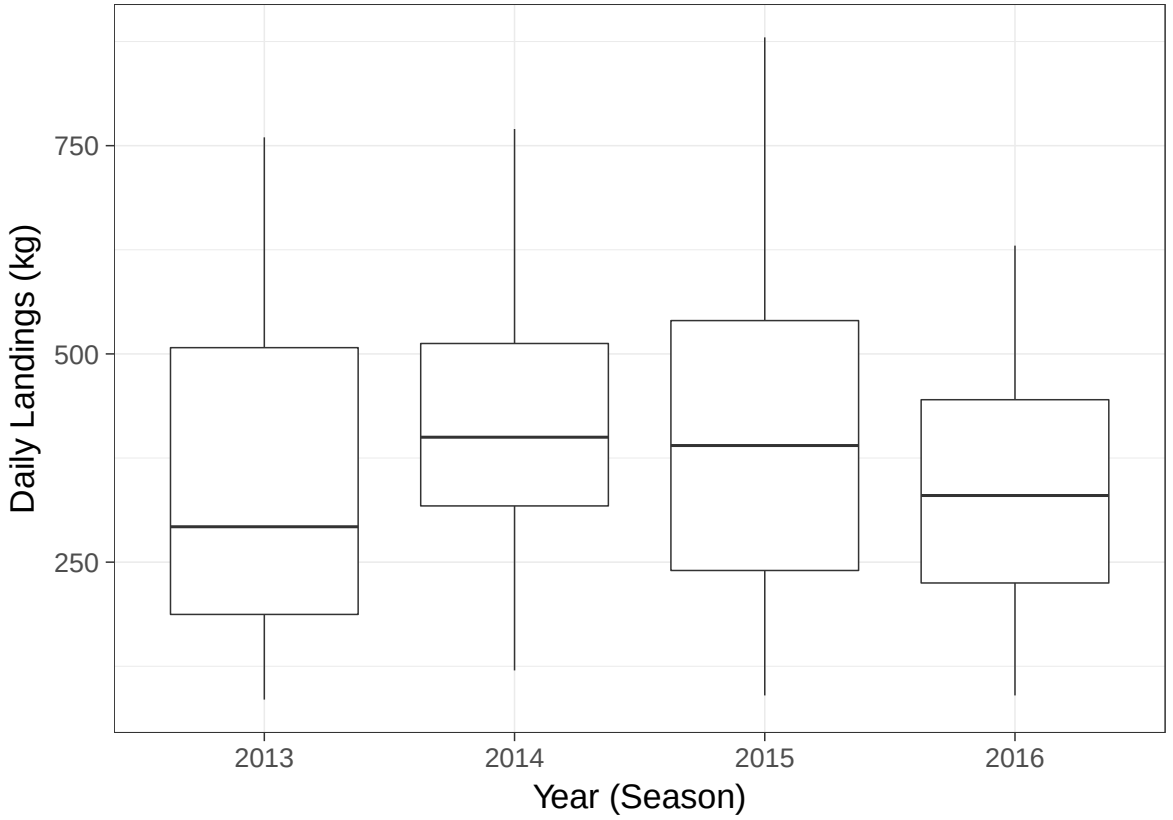
- 26 owner-operators x 9 nets
- Each determine where to set their nets

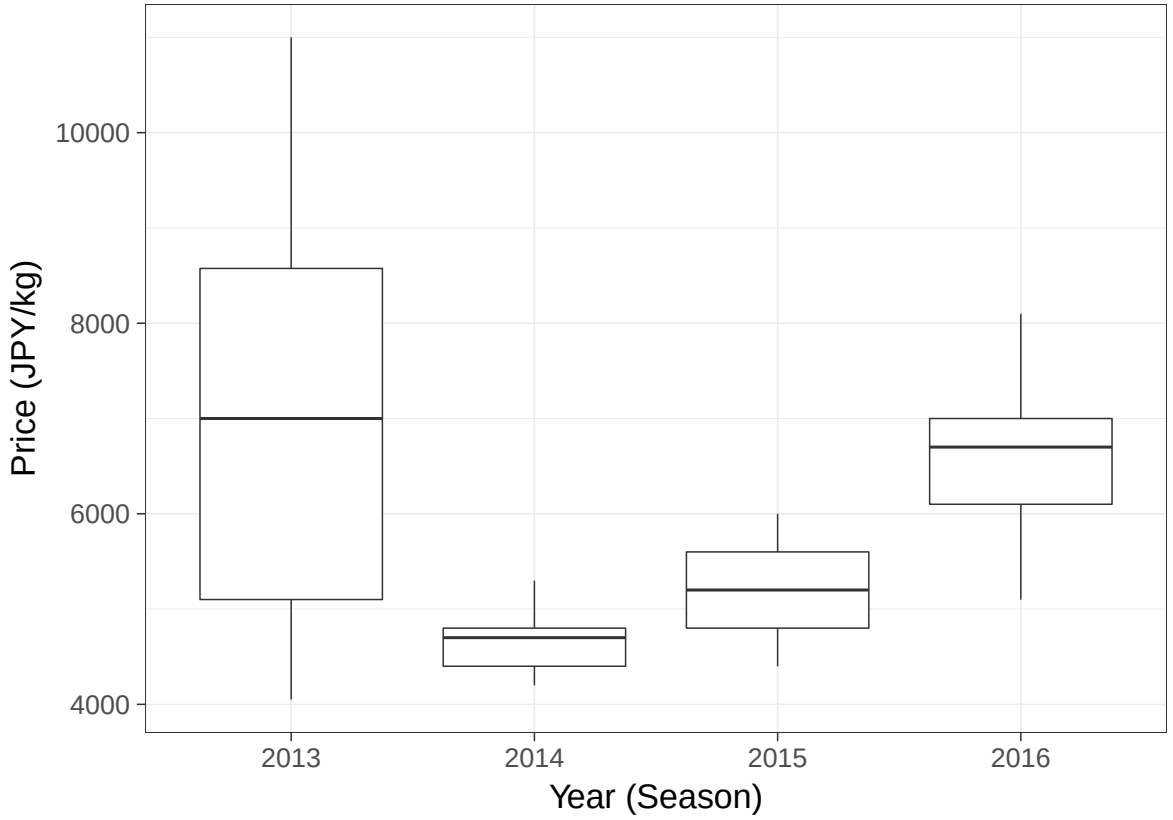
Did it work?

- Making sense of the current management
  - Institutional outcome
    - Income
    - Spatial efficiency
      - Costello & Deacon (2007):
        - ITQ is not perfect, especially when **stocks are economically heterogeneous**
        - The inefficiencies can be eliminated either by defining ITQ rights more precisely or by **an agreement among harvesters to coordinate their effort**

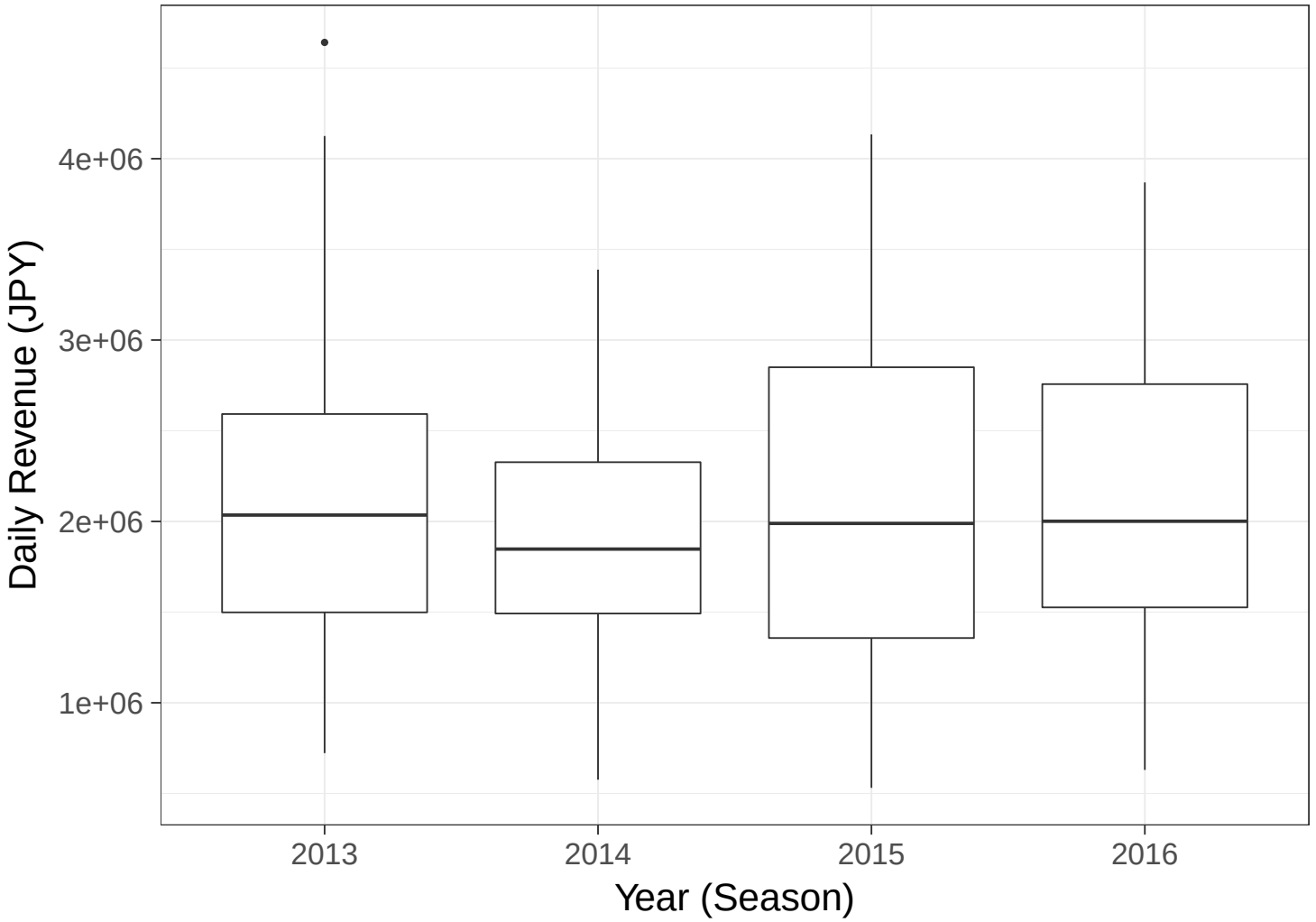
Income

Group operation period



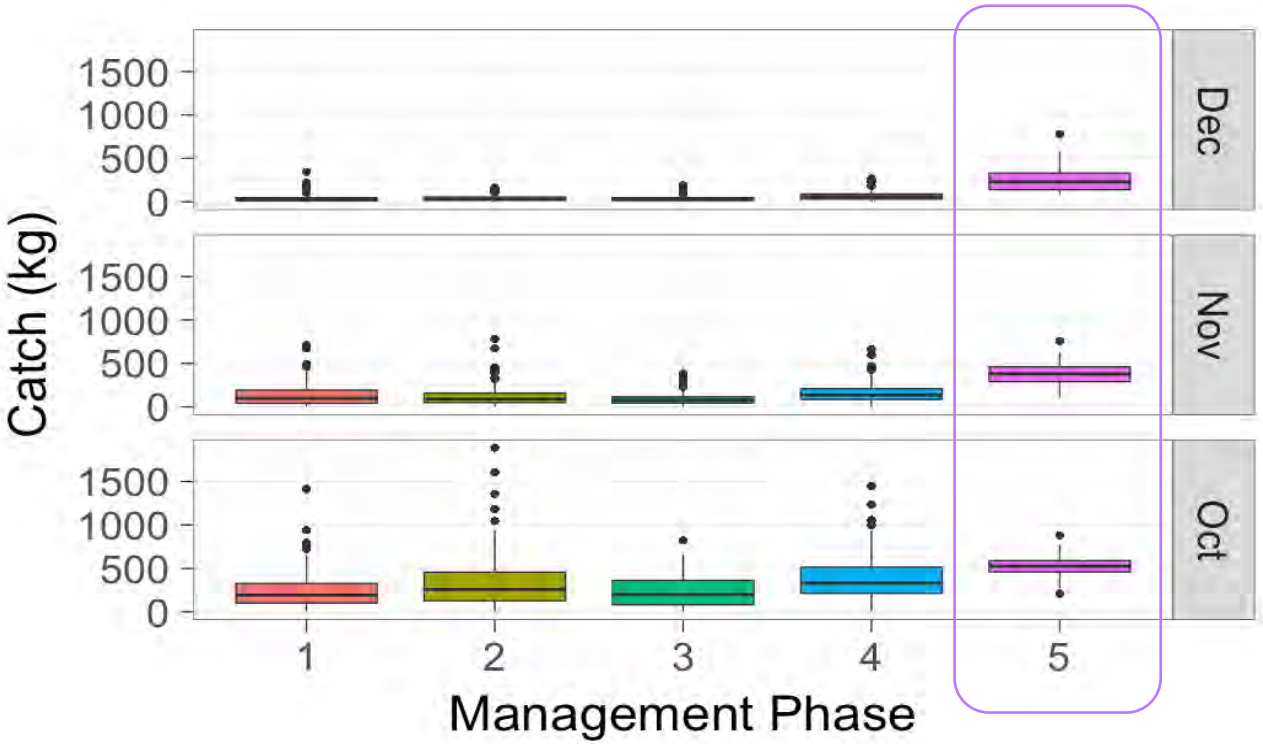


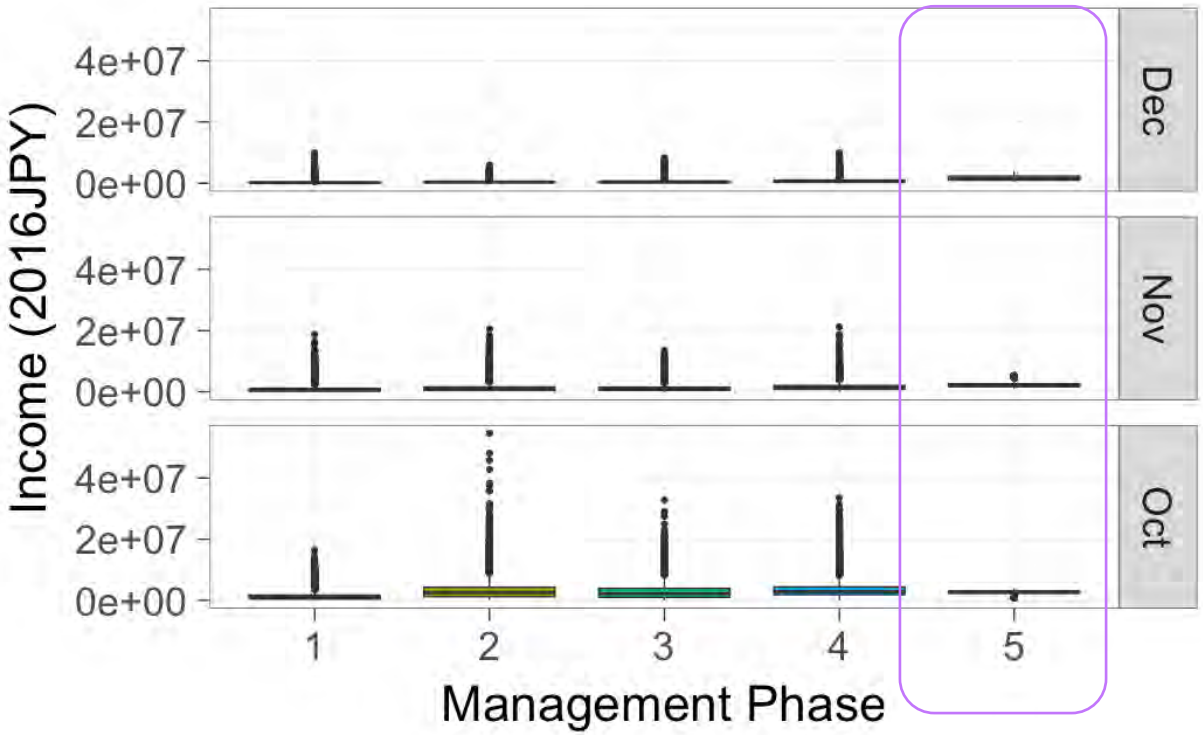
Group operation (income)



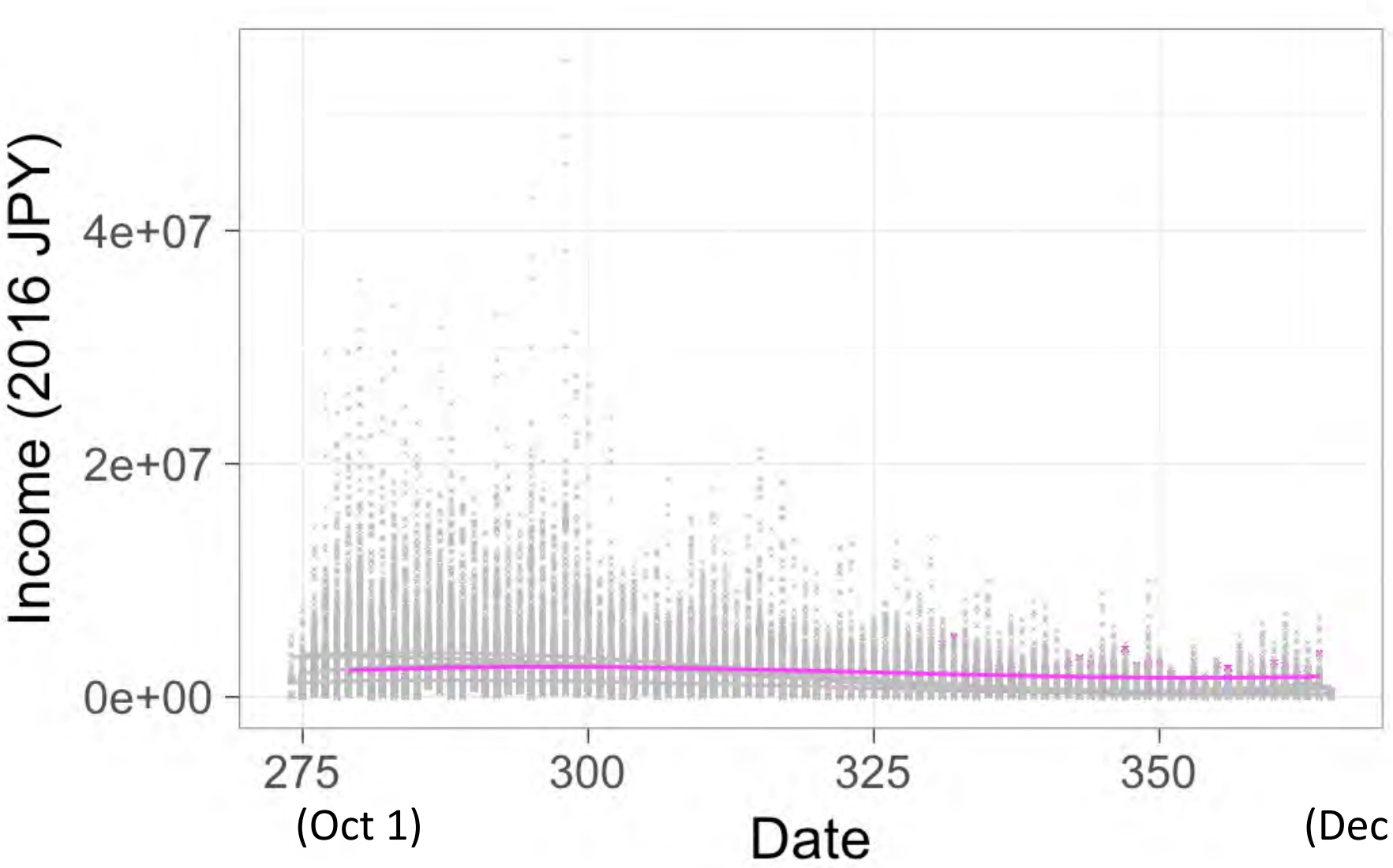
Price and harvest fluctuates from year to year but the revenue (i.e. harvest values) are constant at least during the pooling period.

Within-season stability





Income stability



(Oct 1)

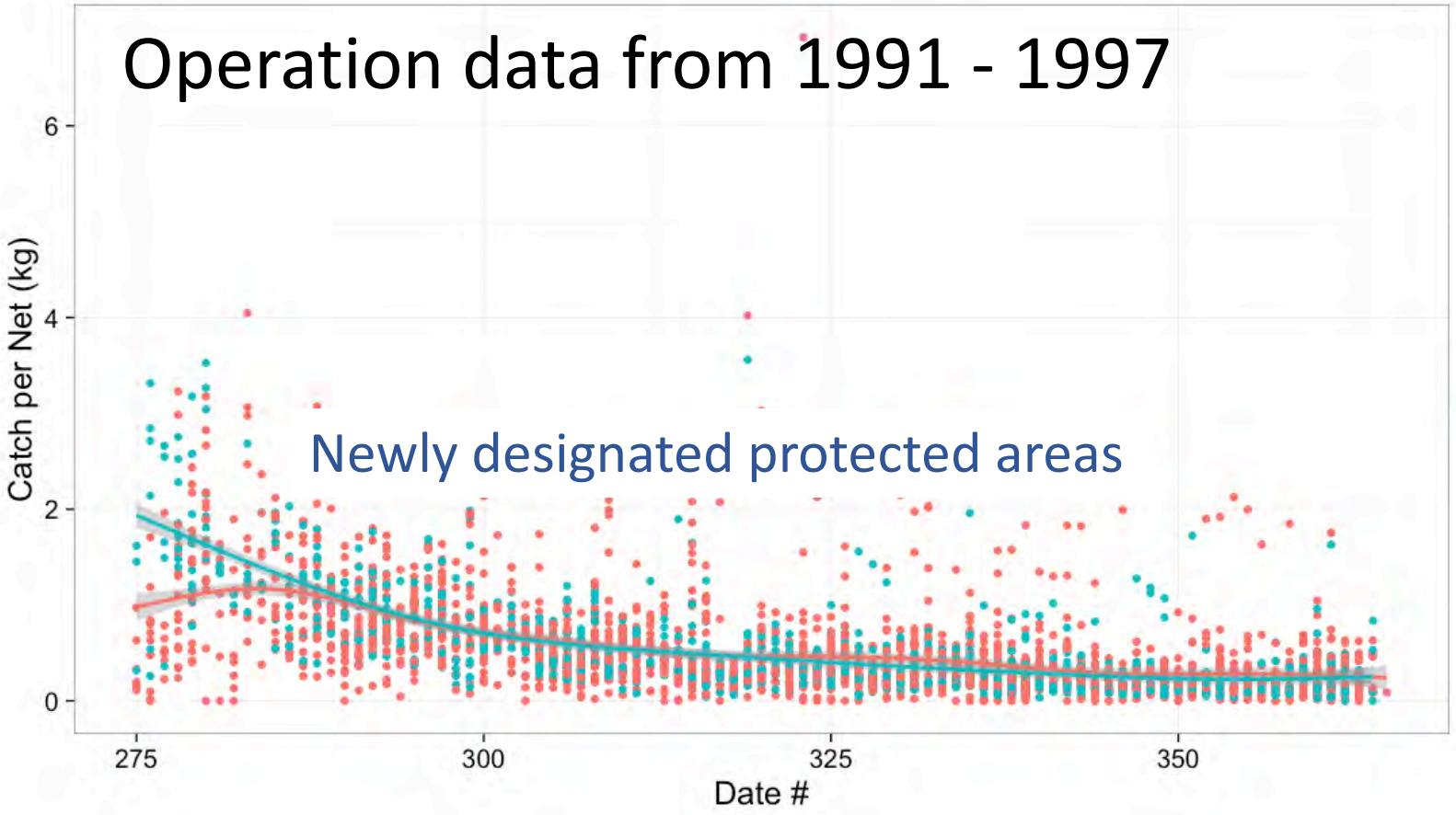
(Dec 29)

Current institution

Higher income in November & December

Spatial fit (ecosystem & economics)

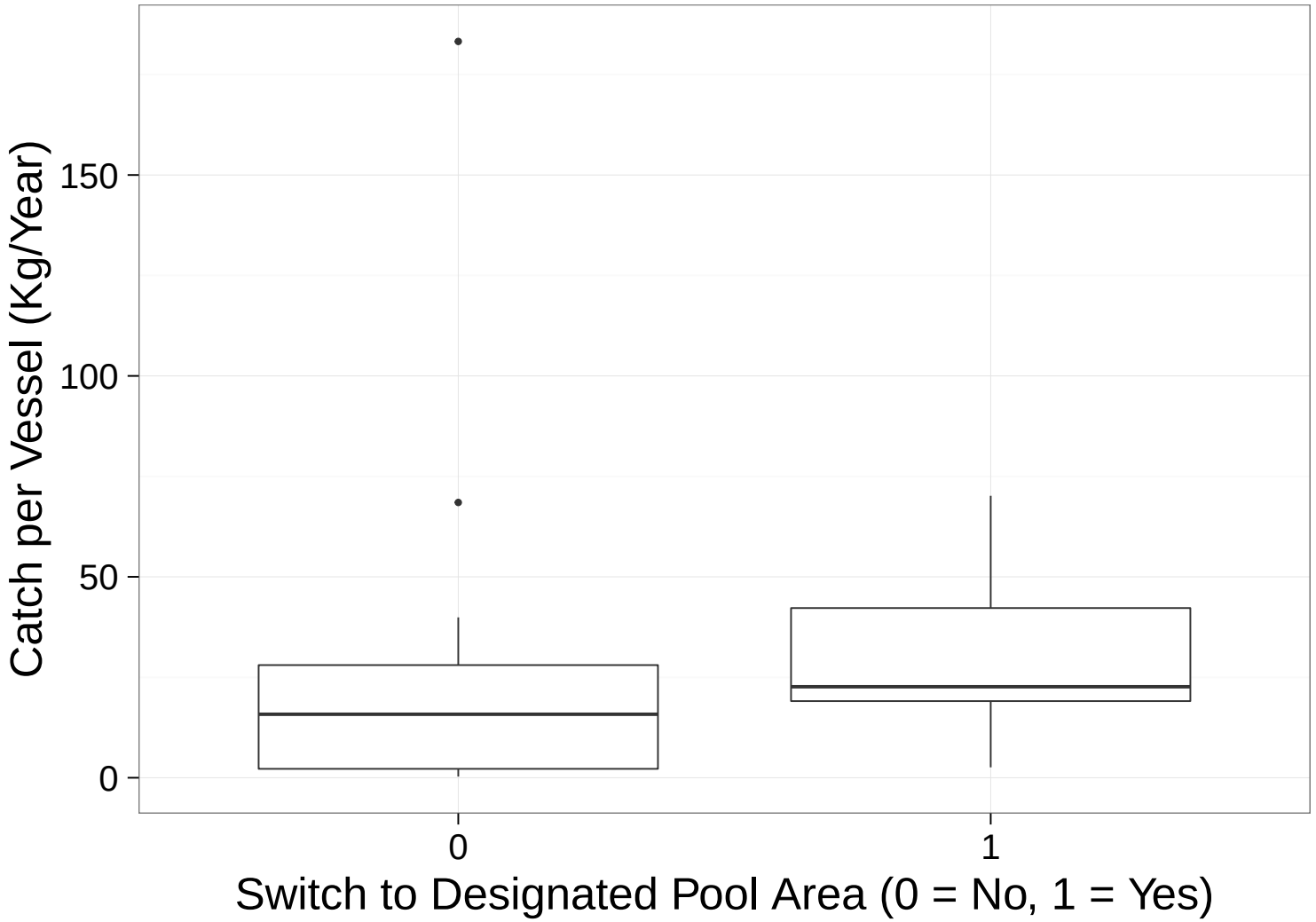
Spatial heterogeneity (Costello & Deacon (2007))



The fishing grounds that were later designated as protected areas had higher CPUE at the beginning of the season

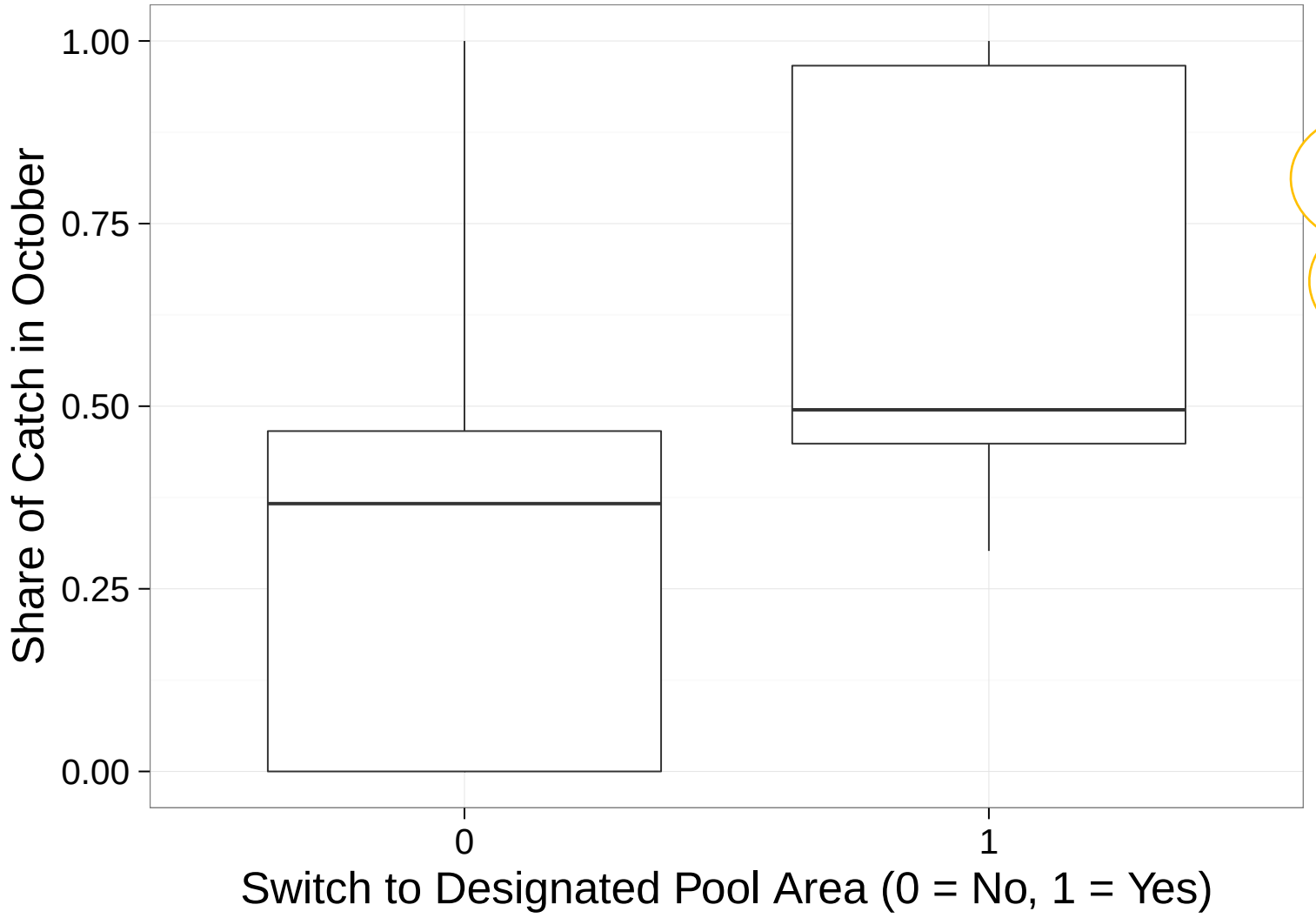
Coordination as a remedy for inefficiency created by spatial heterogeneity

Which fishing grounds were later designated as the pooling operation area?



"Areas where only a few vessels are benefiting from"
(interview with local fishermen)

Which fishing grounds were later designated as the pooling operation area?



"Areas with high productivity"

Recall Costello & Deacon (2007)

Logit model

	Dependent variable:		
	Switch to Protected Area		
	(1)	(2)	(3)
Share of Catch in October	11.291*	**11.125****	3.927*
	(5.810)	(5.589)	(2.217)
Share of Operation in October	-6.976	-7.256*	
	(4.506)	(4.349)	
Number of Operation in Year	0.096	0.053	0.155
	(0.174)	(0.059)	(0.146)
Annual Catch per Vessel	-0.011	-0.013	-0.002
	(0.025)	(0.023)	(0.021)
Total No. of Vessels in October	-0.053		-0.136
	(0.202)		(0.173)
Constant	-5.186*	-4.806**	-4.164**
	(2.702)	(2.131)	(1.957)
Observations	32	32	32
Log Likelihood	-12.677	-12.712	-14.025
Akaike Inf. Crit.	37.354	35.424	38.050
Note:			*p<0.1; **p<0.05; ***p<0.01

Logit model Interpretation

	Dependent variable:	
	Switch to Protected Area	
	(odds ratio)	(marginal effects)
Share of Catch in October	67,844.390**	1.186**
	(5.589)	(0.553)
Share of Operation in October	0.001*	-0.774
	(4.349)	(0.477)
Number of Operation in Year	1.055	0.006
	(0.059)	(0.006)
Annual Catch per Vessel	0.987	-0.001
	(0.023)	(0.003)
Constant	0.008**	
	(2.131)	
Observations	32	
Log Likelihood	-12.712	
Akaike Inf. Crit.	35.424	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Predicted probability

When the predictor values are hold to their means, the probability of the fishing ground switching to protected area = 12.1%.

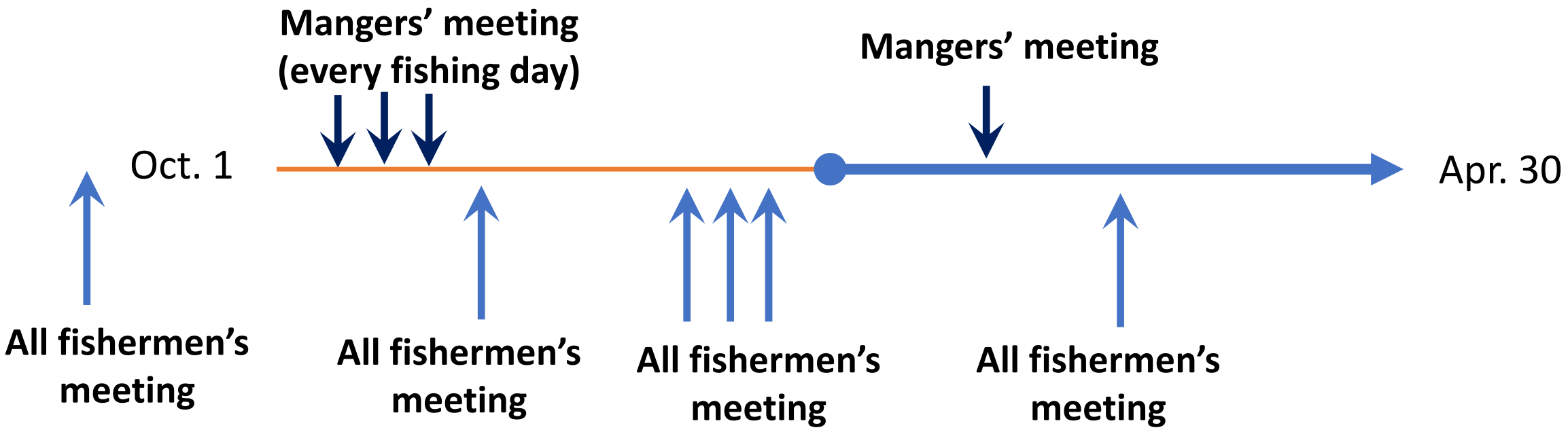
Marginal effect

Marginal ↑in share of the catch in October

➔ ↑ probability of the fishing ground switching to protected area by 119%.

Sources of adaptive management

- Two type of meeting for decision making mechanism:
    1. All fisherman's meeting
    2. Managers' meeting: Chair/ Vice-chair + representative of 5 groups
- Yearly cycle:



Adapting to the natural environment

1. Switching from one operation mode to another
2. Resuming the fishing or taking a break from fishing
3. **Modification of institutions or decisions to adapt to (extreme) weather conditions**
   - **2 typhoons**

     13th October 2016: Operating on lunar close days
   - **Bad winter weather**

     27th December 2015: Shift to individual operation on 4th January

     →9th January 2016: Continue with group operation

Remaining question

Fishermen's expectation:

"Gaining profit without much labour"

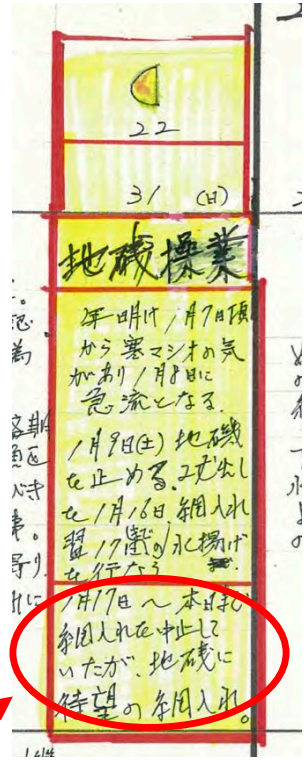
Stable income

Economic efficiency

↓ cost, ↓ risk, spatial coordination

If group operation = "social fit",

then why shift to individual operation?

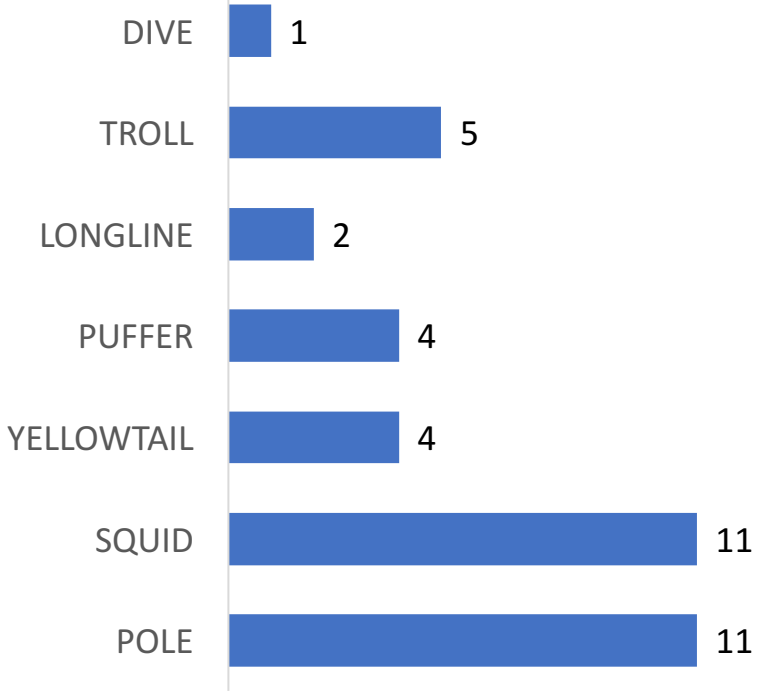


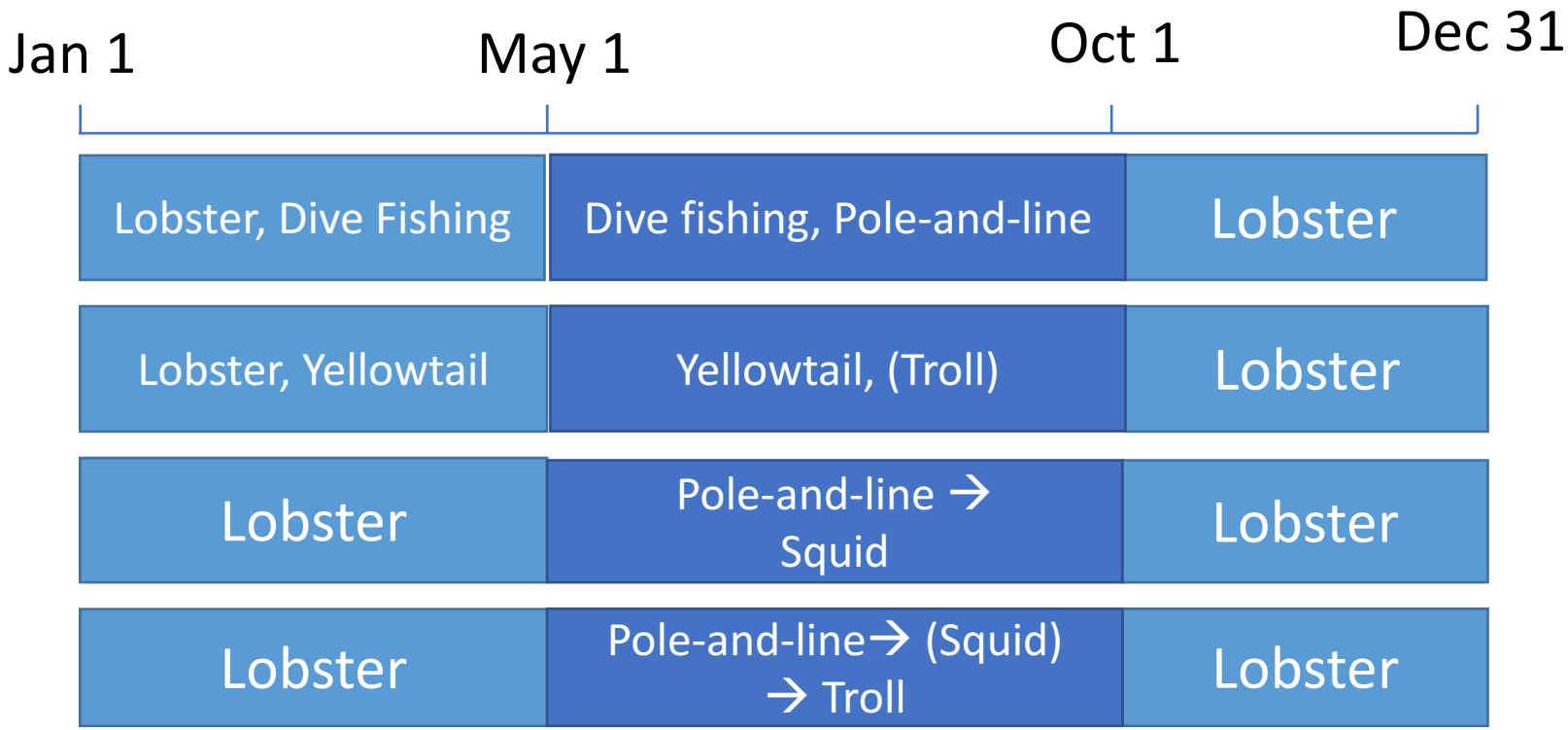
"Long waited" beginning of individual operation!

Heterogeneity in opportunity cost

- **Opportunity cost**: value of the next best option forgone
  - Alternative fishing conducted by the lobster fishermen

N = 15 (out of 26)
Multiple answers allowed





Source: Interview & survey (April 2017) conducted by the presenters

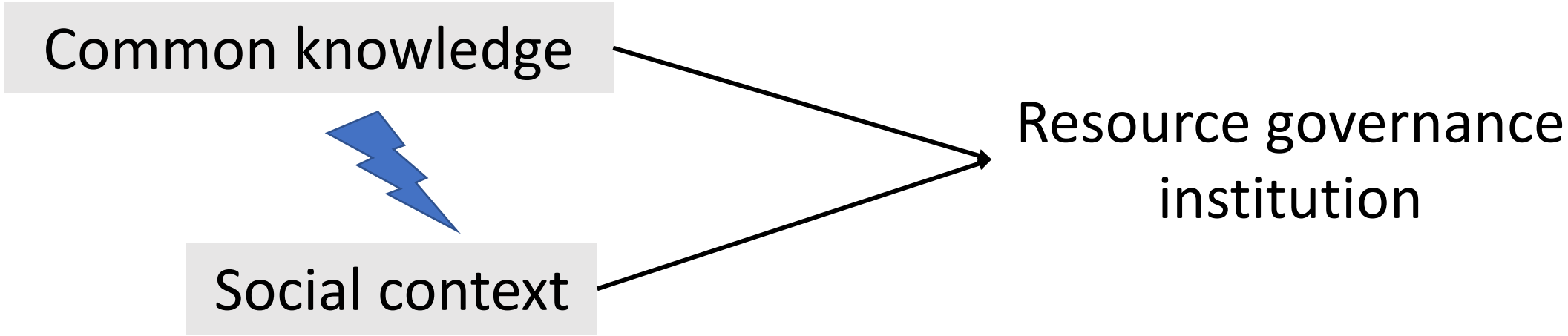
Individual Operation & Variations in Opportunity Cost

- Opportunity costs differ
  - Across individuals
    - Due to alternative fishing practice
  - Across years
    - Due to stock conditions of the alternative target species
      - Ex. Skipjack tuna fishery productivity depends on oceanic conditions and other factors

By switching to individual operation, they may be able to achieve better institutional fit (adaptive governance?)

Conclusion

- Adaptive management institution



Embed in the resource governance mechanism resource users' common knowledge of the ecosystem functioning and social context

THANK YOU

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&
Mie Prefecture

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